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(54) SYSTEM AND METHOD FOR SECURELY DISTRIBUTING DIGITAL CONTENT FOR SHORT TERM USE

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(57) ABSTRACT

A system and method for use in a communication network that communicates with a plurality of digital content servers to provide selected digital data files, including video and audio files, for download to a subscriber device. A segmentation controller is provided for dividing the selected into segments. An encryption controller is provided for compressing and encrypting each of the segments with a selected one of a plurality of encryption keys. The segments are then transmitted at or above the average bandwidth of the communication network to a subscriber device. A copy of the decryption keys are transmitted to the subscriber device to enable playback of the selected file only with a current verification of the subscriber device.

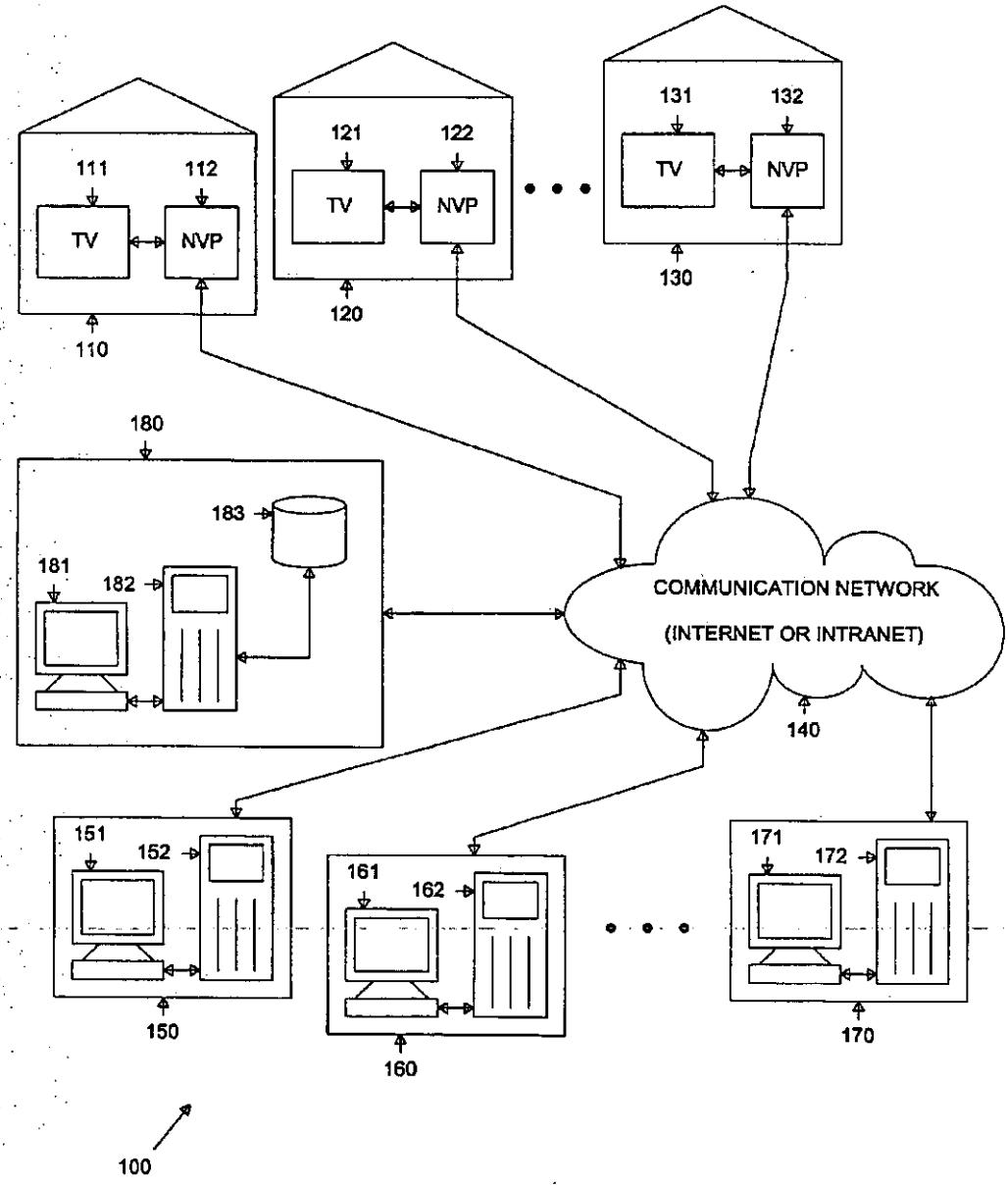
111
112
TV
NVP
110
121
122
TV
NVP
120
131
132
TV
NVP
130
180
183
181
182
COMMUNICATION NETWORK
(INTERNET OR INTRANET)
140
151
152
150
161
162
160
171
172
170
100

FIGURE 1

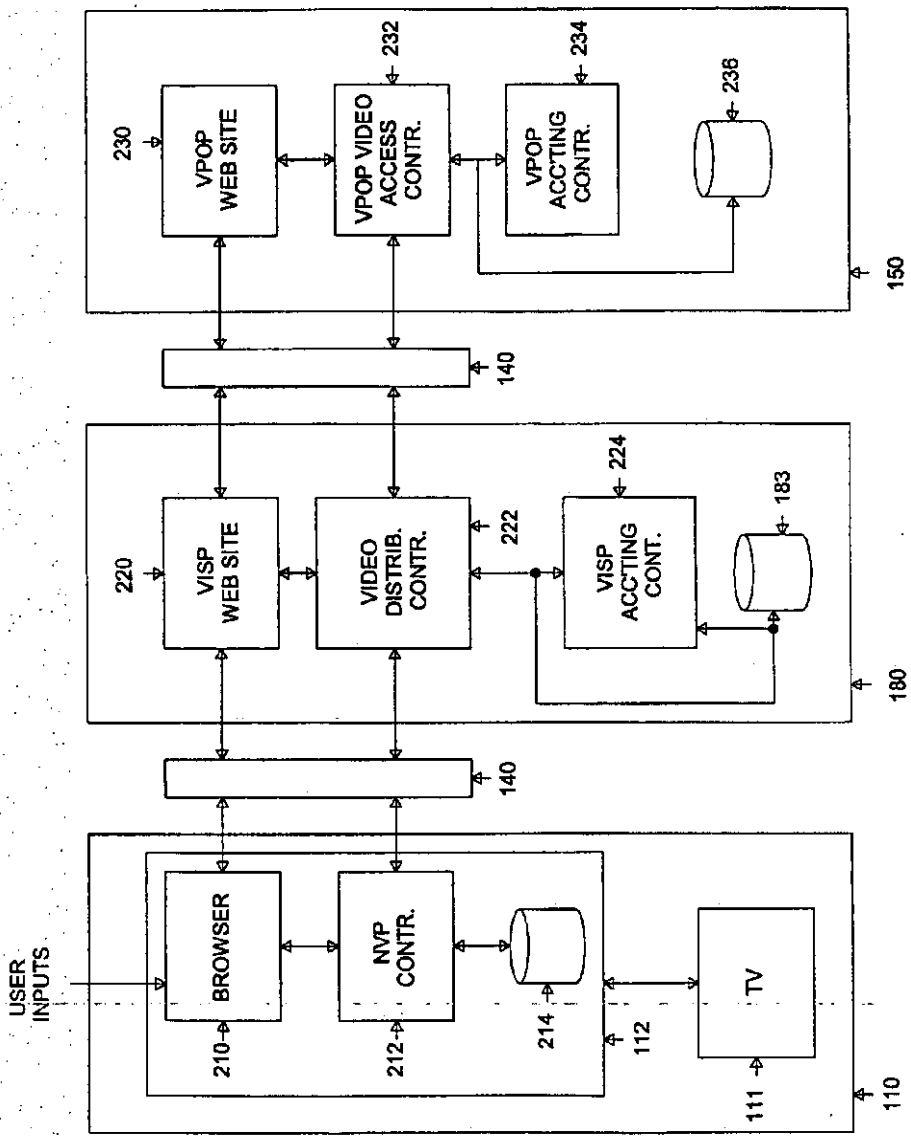
USER INPUTS
BROWSER
210
NVP CONTR.
212
214
112
TV
111
110
140
VISP WEB SITE
220
VIDEO DISTRIB. CONTR.
222
VISP ACCTING CONT.
224
183
180
140
VPOP WEB SITE
230
VPOP VIDEO ACCESS CONTR.
232
VPOP ACCTING CONTR.
234
236
150

FIGURE 2

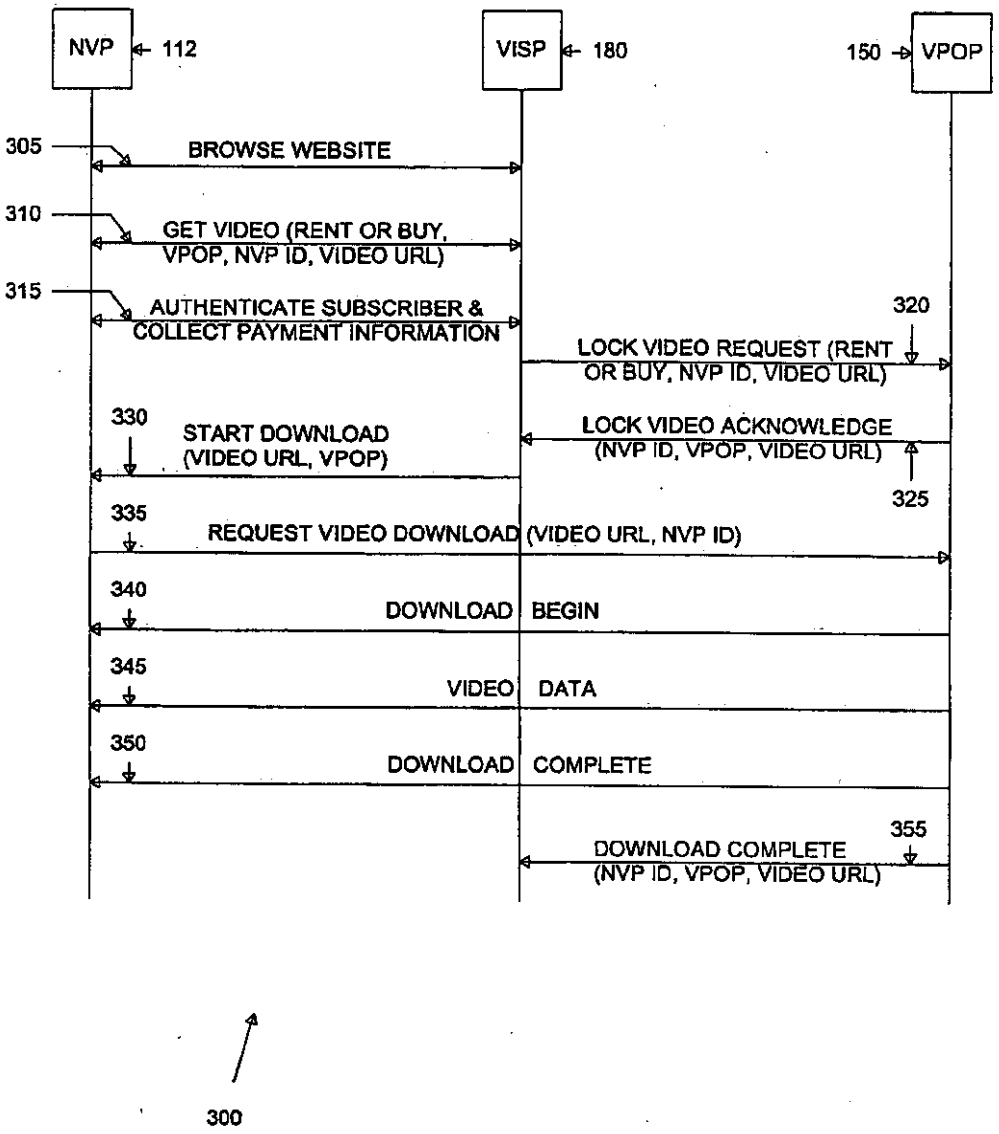
NVP
112
VISP
180
150
VPOP
305
BROWSE WEBSITE
310
GET VIDEO (RENT OR BUY, VPOP, NVP ID, VIDEO URL)
315
AUTHENTICATE SUBSCRIBER & COLLECT PAYMENT INFORMATION
320
LOCK VIDEO REQUEST (RENT OR BUY, NVP ID, VIDEO URL)
330
START DOWNLOAD (VIDEO URL, VPOP)
LOCK VIDEO ACKNOWLEDGE (NVP ID, VPOP, VIDEO URL)
325
335
REQUEST VIDEO DOWNLOAD (VIDEO URL, NVP ID)
340
DOWNLOAD BEGIN
345
VIDEO DATA
350
DOWNLOAD COMPLETE
355
DOWNLOAD COMPLETE (NVP ID, VPOP, VIDEO URL)
300

FIGURE 3

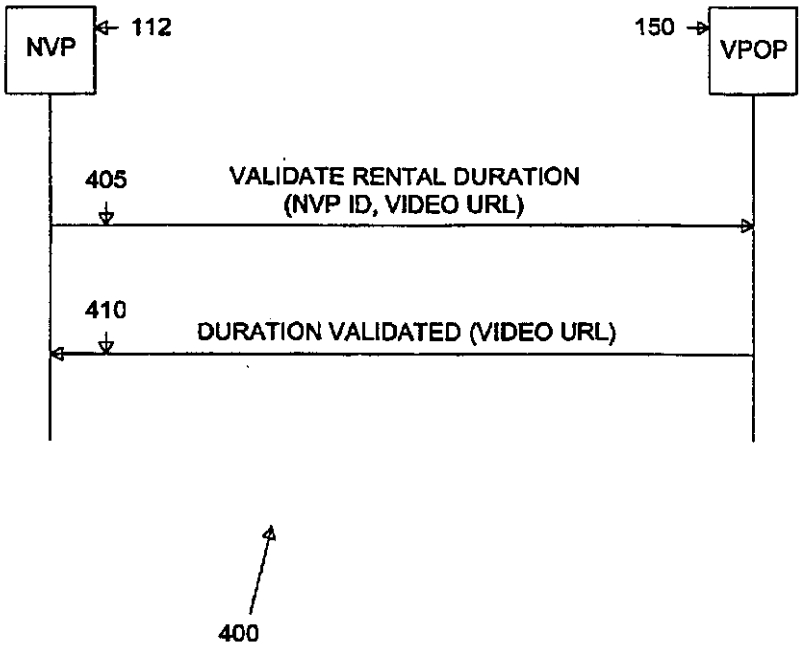
NVP
112
150
VPOP
405
VALIDATE RENTAL DURATION
(NVP ID, VIDEO URL)
410
DURATION VALIDATED (VIDEO URL)
400

FIGURE 4

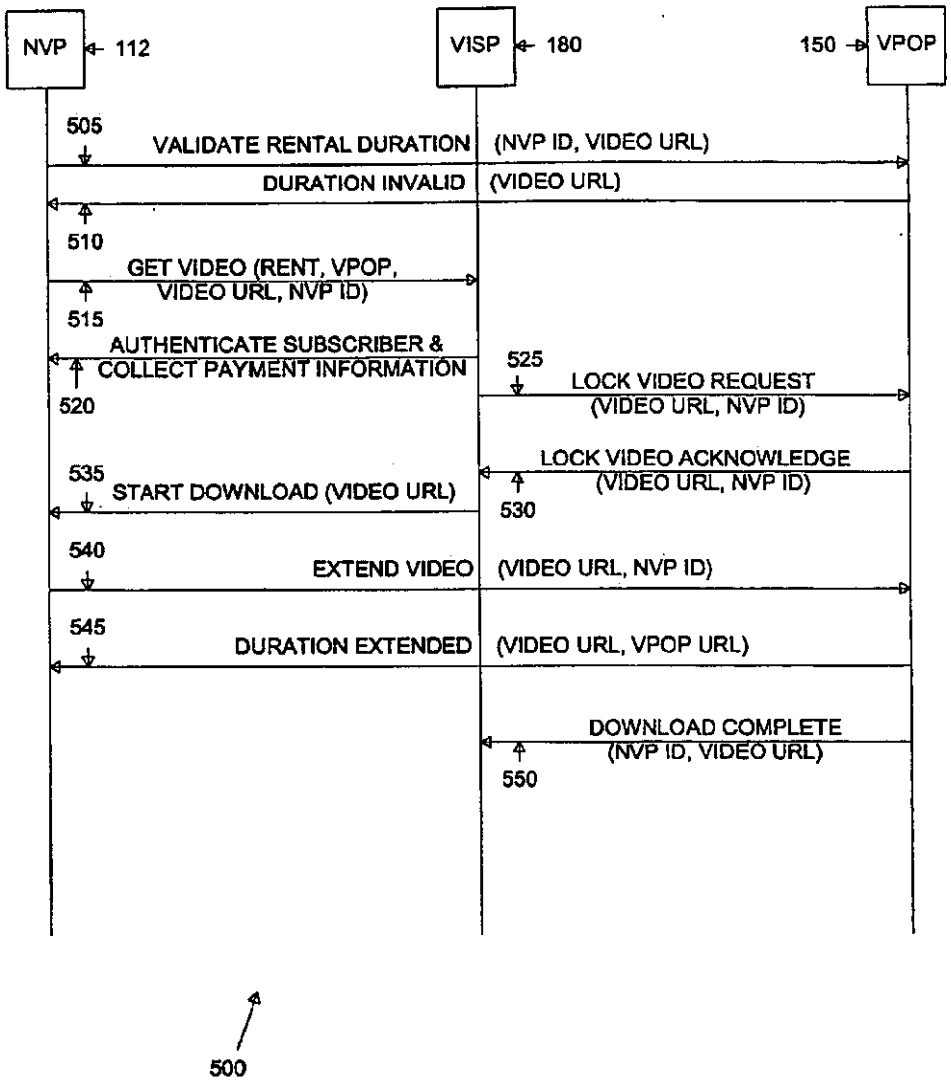
NVP
112
VISP
180
150
VPOP
505
VALIDATE RENTAL DURATION
(NVP ID, VIDEO URL)
DURATION INVALID
(VIDEO URL)
510
GET VIDEO (RENT, VPOP, VIDEO URL, NVP ID)
515
AUTHENTICATE SUBSCRIBER & COLLECT PAYMENT INFORMATION
520
525
LOCK VIDEO REQUEST
(VIDEO URL, NVP ID)
LOCK VIDEO ACKNOWLEDGE
(VIDEO URL, NVP ID)
530
535
START DOWNLOAD (VIDEO URL)
540
EXTEND VIDEO
(VIDEO URL, NVP ID)
545
DURATION EXTENDED
(VIDEO URL, VPOP URL)
DOWNLOAD COMPLETE
(NVP ID, VIDEO URL)
550
500

FIGURE 5

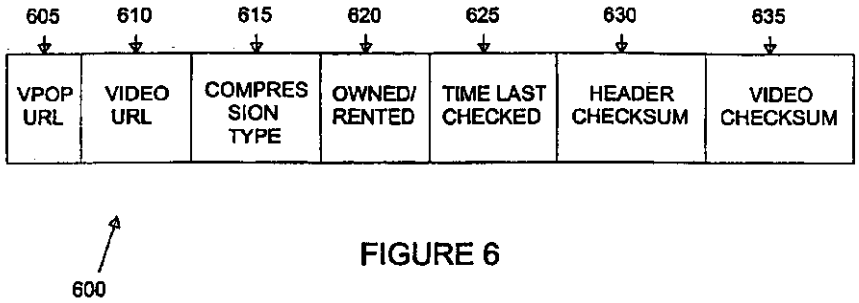

FIGURE 6

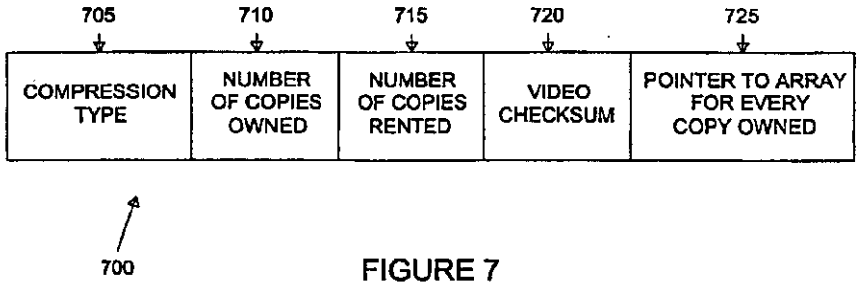

FIGURE 7

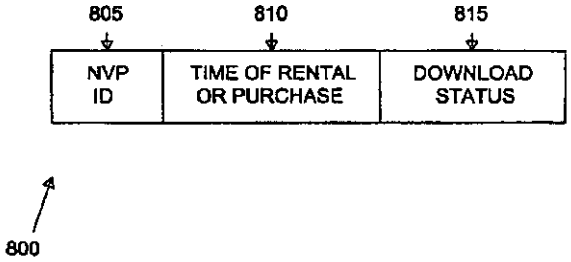

FIGURE 8

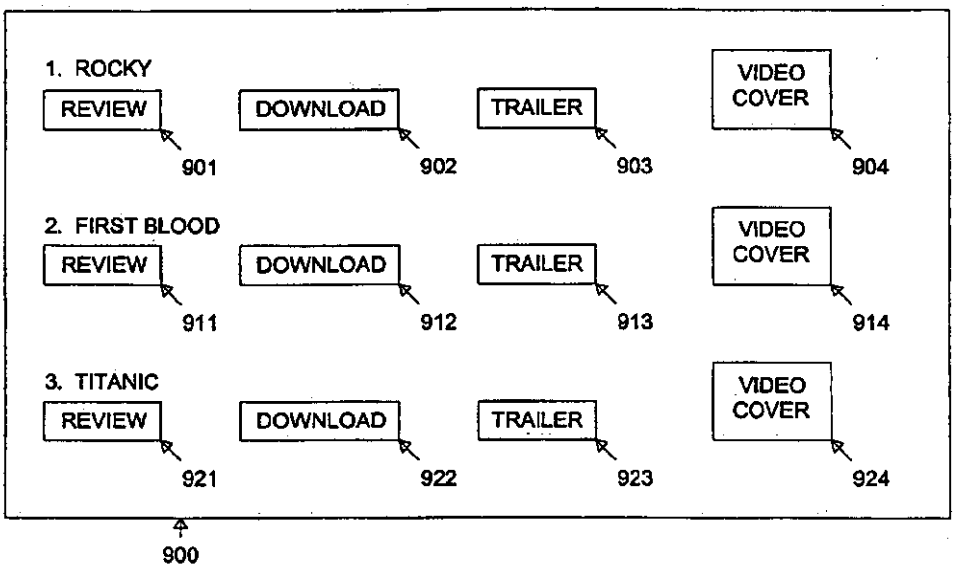

FIGURE 9

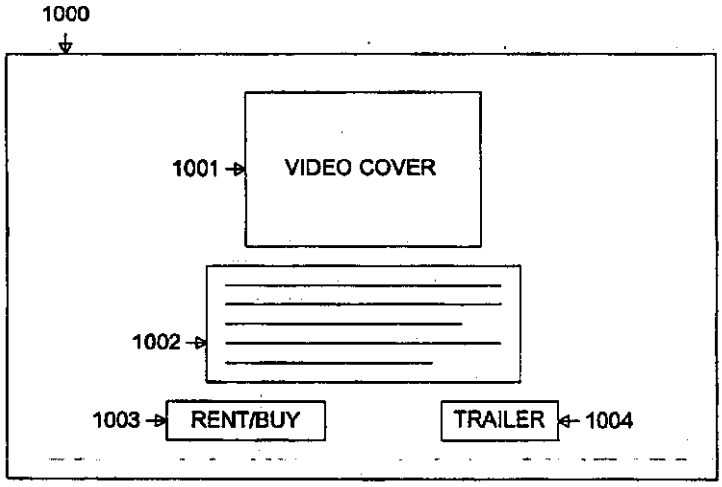

FIGURE 10

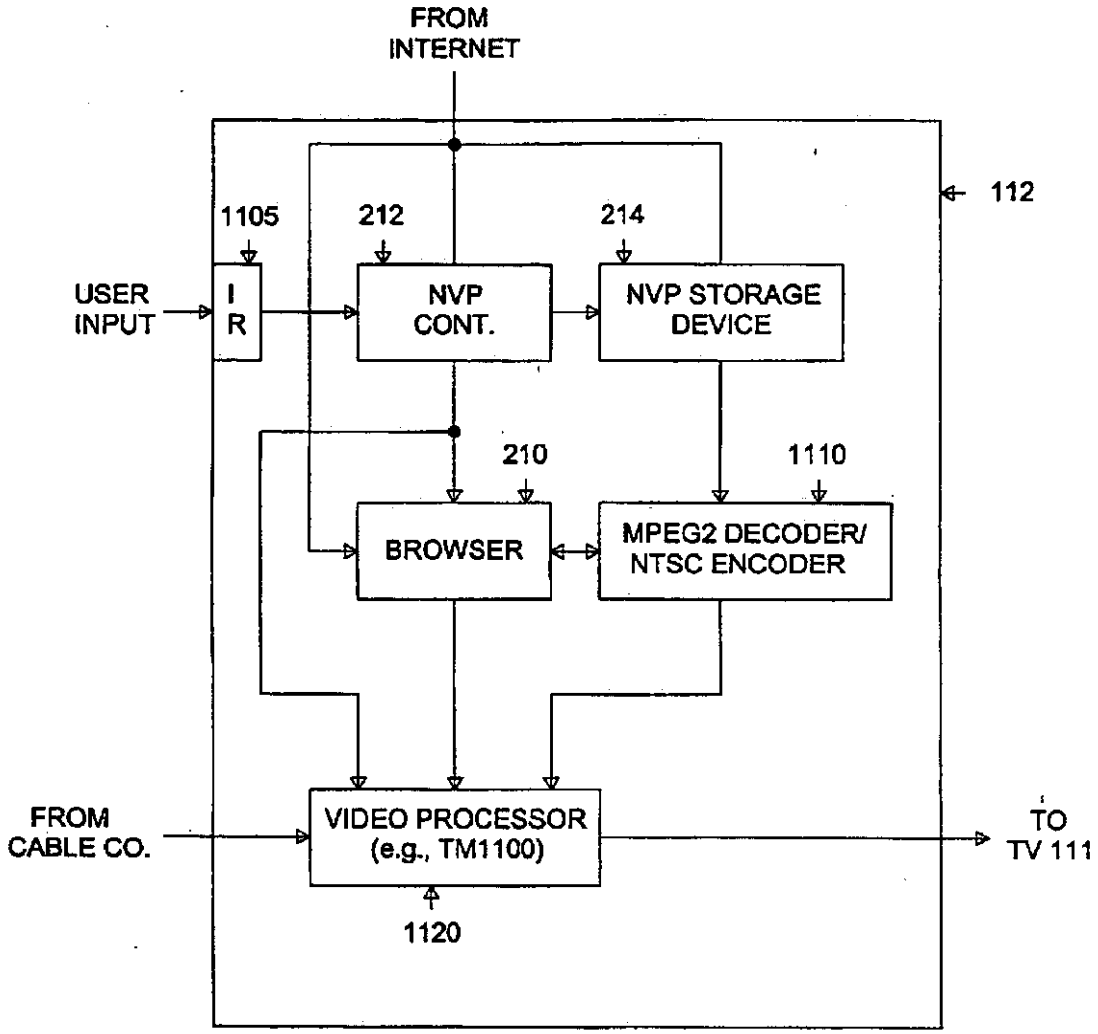
FROM INTERNET
112
1105
212
214
USER INPUT
I R
NVP CONT.
NVP STORAGE DEVICE
210
1110
BROWSER
MPEG2 DECODER/ NTSC ENCODER
FROM CABLE CO.
VIDEO PROCESSOR (e.g., TM1100)
TO TV 111
1120

FIGURE 11

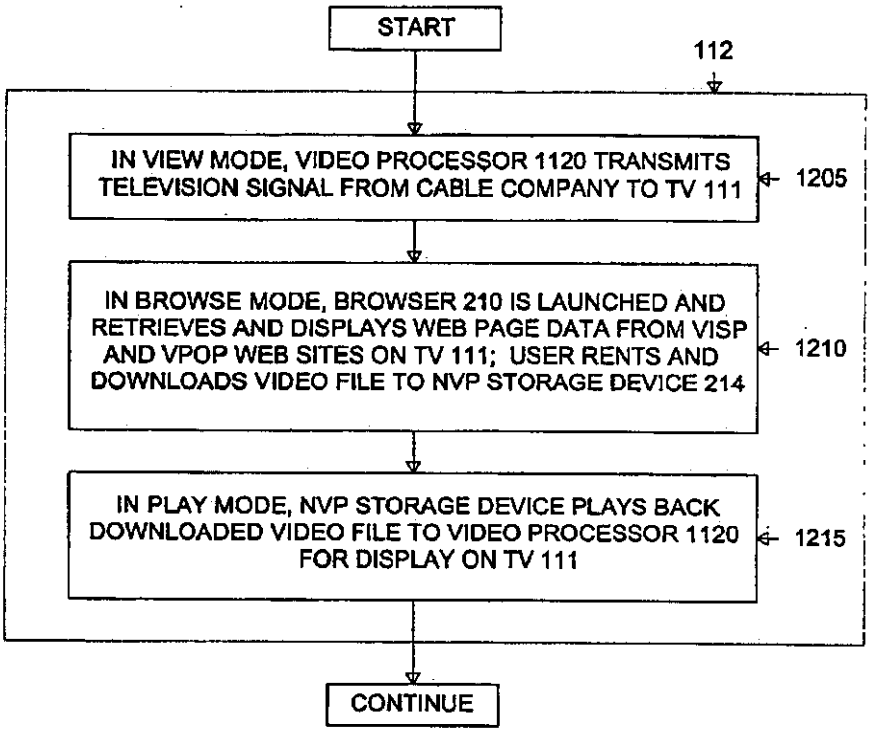
START
112
IN VIEW MODE, VIDEO PROCESSOR 1120 TRANSMITS TELEVISION SIGNAL FROM CABLE COMPANY TO TV 111
1205
IN BROWSE MODE, BROWSER 210 IS LAUNCHED AND RETRIEVES AND DISPLAYS WEB PAGE DATA FROM VISP AND VPOP WEB SITES ON TV 111; USER RENTS AND DOWNLOADS VIDEO FILE TO NVP STORAGE DEVICE 214
1210
IN PLAY MODE, NVP STORAGE DEVICE PLAYS BACK DOWNLOADED VIDEO FILE TO VIDEO PROCESSOR 1120 FOR DISPLAY ON TV 111
1215
CONTINUE
1200

FIGURE 12

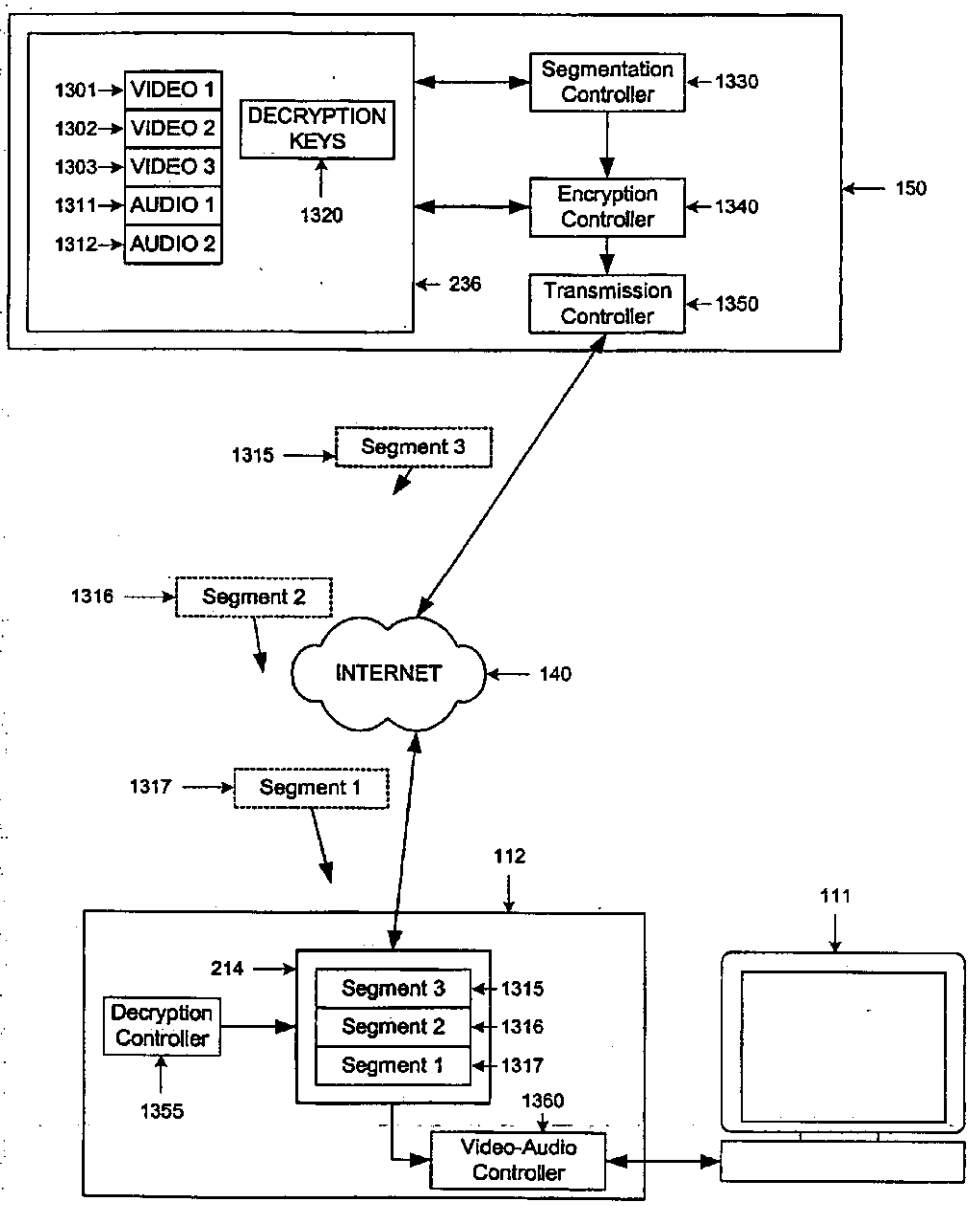
1301
VIDEO 1
1302
VIDEO 2
1303
VIDEO 3
1311
AUDIO 1
1312
AUDIO 2
DECRYPTION KEYS
1320
236
Segmentation Controller
1330
Encryption Controller
1340
Transmission Controller
1350
150
1315
Segment 3
1316
Segment 2
INTERNET
140
1317
Segment 1
112
111
214
Segment 3
1315
Segment 2
1316
Segment 1
1317
Decryption Controller
1355
1360
Video-Audio Controller

FIGURE 13

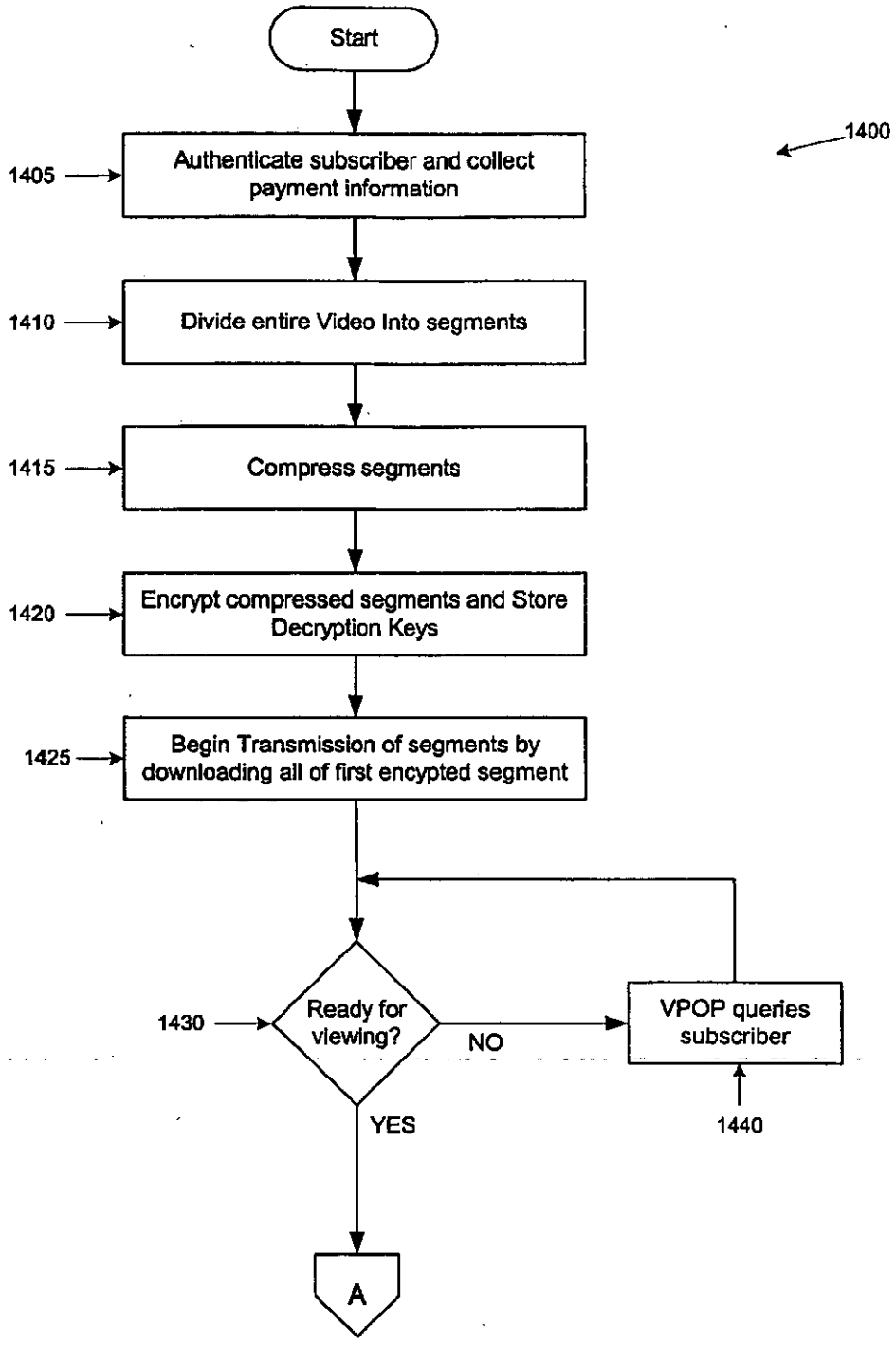
Start
1400
1405
Authenticate subscriber and collect payment information
1410
Divide entire Video Into segments
1415
Compress segments
1420
Encrypt compressed segments and Store Decryption Keys
1425
Begin Transmission of segments by downloading all of first encypted segment
1430
Ready for viewing?
NO
VPOP queries subscriber
1440
YES
A

FIGURE 14A

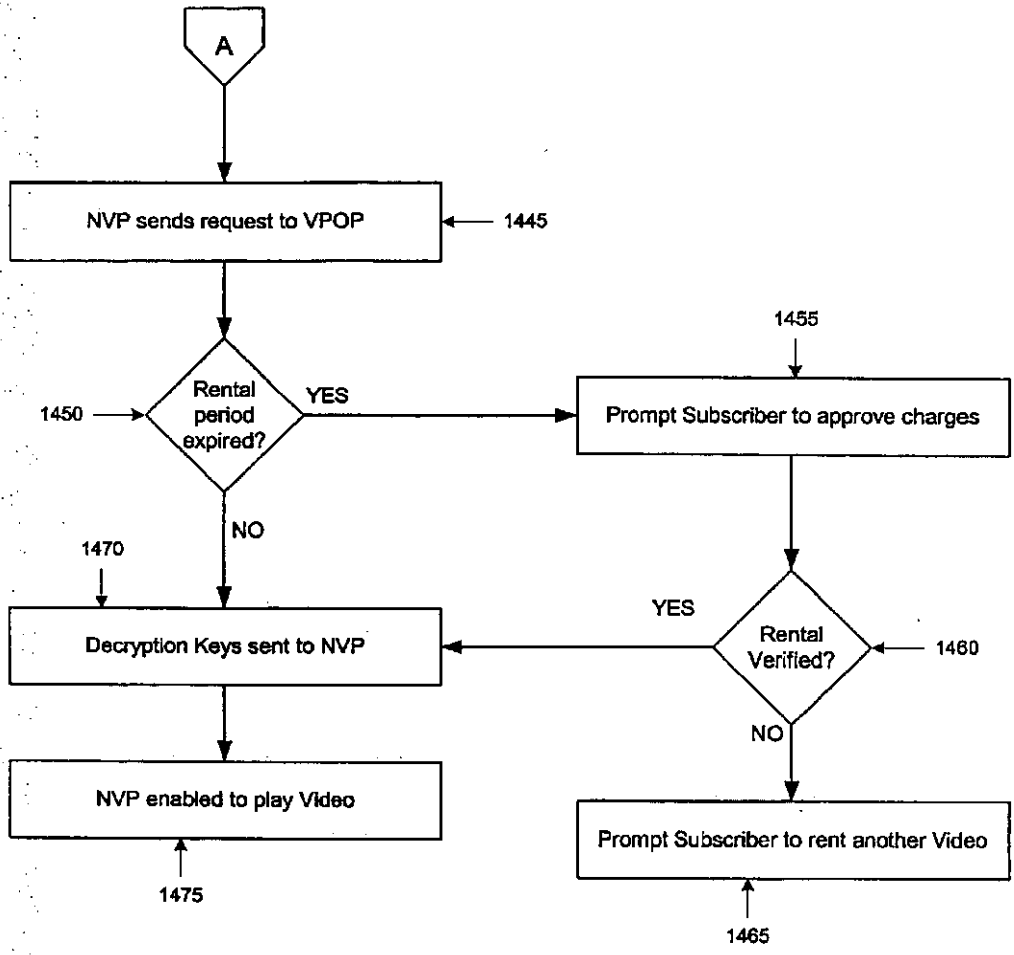
A
NVP sends request to VPOP
1445
1455
Rental period expired?
1450
YES
Prompt Subscriber to approve charges
NO
1470
YES
Rental Verified?
1460
Decryption Keys sent to NVP
NO
NVP enabled to play Video
Prompt Subscriber to rent another Video
1475
1465

FIGURE 14B

SYSTEM AND METHOD FOR SECURELY DISTRIBUTING DIGITAL CONTENT FOR SHORT TERM USE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present invention is related to those disclosed in the following United States patent applications:

[0002] 1. Provisional Ser. No. 60/153,735, filed on Sep. 13, 1999, entitled "SYSTEMS FOR CONTROLLING INTERNET BASED DISTRIBUTION OF VIDEO AND OTHER DATA AND METHODS OF OPERATING THESE SYSTEMS";

[0003] 2. Ser. No. 09/547,204, filed on Apr. 12, 2000, entitled "SYSTEMS AND METHODS FOR CONTROLLING INTERNET-BASED DISTRIBUTION OF VIDEO AND OTHER DATA";

[0004] 3. Ser. No. 09/621,839, filed on Jul. 24, 2000, entitled "SYSTEM AND METHOD FOR EXTENDING RENTAL PERIOD OF DOWNLOADED VIDEO."

[0005] 4. Ser. No. 09/656,553, filed on Sep. 6, 2000, entitled "SET-TOP BOX FOR INTERNET-BASED DISTRIBUTION OF VIDEO AND OTHER DATA."

[0006] The above applications are commonly assigned to the assignee of the present invention. The disclosures of these related patent applications are hereby incorporated by reference into the present disclosure, as if fully set forth herein.

TECHNICAL FIELD OF THE INVENTION

[0007] The present invention relates generally to systems and methods for securely distributing digital content, including video files, via a public communications network. More particularly, the present invention relates to systems and methods for delivering digital content while maintaining full control over the digital content from servers administered by the content owners.

BACKGROUND OF THE INVENTION

[0008] Every year millions of consumers rent videos from video rental stores such as BLOCKBUSTER®. Video stores provide videos on video cassette recorder (VCR) tapes and on digital versatile disks (DVDs). One of the attractive features of renting or buying a video is that it offers a person an opportunity to shop for a wide variety of movies, including recent studio releases and older movies that have been out of theaters for a long time. The attractive movie box covers displayed on shelves in a video store serve to remind shoppers of movies they may have missed when the movies were still in theaters. The box covers also introduce shoppers to movies with which they are unfamiliar.

[0009] Another attractive feature of renting or buying a video is that it provides a person with the convenience of watching a particular movie when the person wants to watch the movie. Thus, the consumer does not have to wait for the movie to be broadcast again in order to view it. Furthermore, if a person rents or buys a video, he or she does not have to watch commercials and does not have to watch the entire movie in one sitting, but may pause the video at his or her convenience. The conveniences of buying or renting a video are particularly important to a consumer whose infrequent television viewing habits do not just justify the cost of paying for premium movie channels, such as HBO® or SHOWTIME®.

[0010] Unfortunately there are numerous inconveniences associated with buying or renting videos from a video store. Every video rental involves the inconvenience of two trips to the video store: one trip to rent the video and one trip to return the video. If the consumer is not able to return the video to the video store by the return deadline, the consumer must pay a daily late fee that frequently is larger than the original daily rental fee. In fact, a significant portion of the revenues of many video stores come from late fees. Many consumers would prefer not to go out in bad weather to rent a video or, more importantly, to return a video.

[0011] Currently, videos may be downloaded from the Internet. Videos, like any other digital content on the Internet, are subject to copying by unauthorized parties. Generally, the preferred method for securely distributing digital content on networks today involves storing the encrypted video (digital content) on a server and then "streaming" that content to a subscriber device where it is decrypted and played back. Streaming means that the encrypted video is formed into packets and the packets are sent at high speed to a receiving device. There are various problems with this approach though. Streaming does not allow the content to be stored locally on the subscriber device. Every time the content is required to be played on the subscriber device it has to be downloaded from the server. This ties up precious network bandwidth and makes multiple use of content, such as video rental, almost impossible to achieve because of the high bandwidth demands placed on the network.

[0012] VCRs enable a user to exercise control over the video tape. For example, video playback machines allow the user to rewind, fast forward, pause, stop and exercise other control while playing the video. If the video is a digital file stored locally, the user is able to exercise the control, available in the VCR, over the digital file. In the streaming mode of operation, the subscriber devices have to go back to the server to exercise these controls. This causes the server to become a severe bottleneck and prevents the solution to scale to a very large number of devices.

[0013] Streaming requires a guaranteed constant bandwidth from the network since there is no local storage of the content. If there are temporary network glitches, the user may experience jerkiness or lost video frames. Most internet protocol (IP) networks (i.e., th Internet) deployed in the real world do not guarantee constant network bandwidth but do offer an average bandwidth of a certain size.

[0014] Because of the problems outlined above, a need exists in the art for a method of securely distributing digital content for short-term use over IP networks that allows the content to be stored locally on the subscriber devices.

SUMMARY OF THE INVENTION

[0015] The present invention provides advantageous embodiments of an Internet-based video rental, sales, and distribution network that allows subscribers to securely buy, rent, or otherwise acquire stored digital content (hereinafter

sometimes referred to as video files or audio files), using a high-speed connection to the Internet. The present invention also provides a software controller for handling transactions to buy, rent or otherwise acquire the digital content over the Internet. However, the present invention is by no means limited to a software controller embodiment and it should be understood that the controller may be implemented in software, hardware, firmware, or some combination of these elements.

[0016] The purchased, rented, or otherwise acquired video and audio file or other data file is downloaded to a subscriber's video player and is then available for local viewing on the subscriber's television or other video display device for the duration of the rental period or indefinitely if the video content is purchased outright.

[0017] One advantageous embodiment of the proposed exemplary system for transmitting digital content over a communication network includes: 1) a memory for storing digital content, in the form of video files or audio files; 2) a segmentation controller capable of dividing the video and audio files into file segments; 3) an encryption controller to encrypt each file segment and storing the decryption keys in the memory and 4) a transmission controller that is capable of determining the average bandwidth of the network at the time of transmission and passing that information to the segmentation controller.

[0018] According to another embodiment of the present invention, the transmission controller is capable of transmitting the stored decryption keys to the subscriber device after receiving a verification of the subscriber device.

[0019] According to still another embodiment of the present invention, the encryption controller is capable of compressing each of the segments of the selected file prior to encryption.

[0020] According to yet another embodiment of the present invention, the segmentation controller is capable of adjusting the size of each of the segments of the selected file.

[0021] According to a further embodiment of the present invention, the segmentation controller may adjust the size of each segment according to network bandwidth parameters received from the transmission controller.

[0022] According to a still further embodiment of the present invention, the segmentation controller is capable of adjusting the size of each segment according to the average bandwidth of the communication network.

[0023] According to another embodiment of the present invention, the decrypting keys will be downloaded to the subscriber device upon verification. However, it is not necessary to download the decryption keys if the selected file is rewound or restarted within a predetermined time period.

[0024] Before undertaking the DETAILED DESCRIPTION OF THE INVENTION, it may be advantageous to set forth definitions of certain words and phrases used throughout this patent document: the terms "include" and "comprise" and their derivatives mean inclusion without limitation; the term "or" is inclusive, meaning and/or; the term "associable" and the phrases "associated with" and "associated therewith" and their derivatives thereof may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, coupled to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like; and the term "controller" means any device, system or part thereof that controls at least one operation. Such a device may be implemented in hardware, firmware or software, or some combination of at least two of the same. It should be noted that the functionality associated with any particular controller may be centralized or distributed, whether locally or remotely. In particular, a controller may comprise one or more data processors, and associated input/output devices and memory, that execute one or more application programs and/or an operating system program. Definitions for certain words and phrases are provided throughout this patent document, those of ordinary skill in the art should understand that in many, if not most instances, such definitions apply to prior, as well as future uses of such defined words and phrases.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, wherein like numbers designate like objects, and in which:

[0026] **FIG. 1** is a block diagram of an exemplary automated video distribution system according to one embodiment of the present invention;

[0027] **FIG. 2** is a more detailed block diagram of selected portions of the exemplary automated video distribution system according to one embodiment of the present invention;

[0028] **FIG. 3** is a message flow diagram illustrating an exemplary end-to-end video rental or sale transaction between an exemplary network video player (NVP), an exemplary video Internet service provider (VISP) network and an exemplary video point-of-presence (VPOP) network according to one embodiment of the present invention;

[0029] **FIG. 4** is a message flow diagram illustrating an exemplary process of viewing a video already rented by the subscriber according to one embodiment of the present invention;

[0030] **FIG. 5** is a message flow diagram illustrating an exemplary process of extending the rental duration for a video already downloaded to an exemplary NVP according to one embodiment of the present invention;

[0031] **FIG. 6** illustrates an exemplary header that may be attached to video files downloaded to an NVP according to one embodiment of the present invention;

[0032] **FIG. 7** illustrates an exemplary header that may be attached to video files stored on a VPOP network according to one embodiment of the present invention;

[0033] **FIG. 8** illustrates an exemplary header that may be attached to records in the VPOP database for each copy of a video rented according to one embodiment of the present invention;

[0034] **FIG. 9** illustrates an exemplary web page from which a subscriber using the exemplary network video

player may select a video to rent or to purchase, according to one embodiment of the present invention;

[0035] **FIG. 10** illustrates an exemplary web page from which a subscriber may learn additional details concerning a selected video, according to one embodiment of the present invention;

[0036] **FIG. 11** is a more detailed block diagram of selected portions of the exemplary network video player according to one embodiment of the present invention;

[0037] **FIG. 12** is a flow chart illustrating the operation of the exemplary network video player according to one embodiment of the present invention;

[0038] **FIG. 13** illustrates in greater detail selected portions of a VPOP network a NVP that download video, audio and other digital data files in block bursts according to one embodiment of the present invention; and

[0039] FIGS. **14A-14B** is a flow chart depicting a method for securely distributing digital content over a network according to one embodiment of the present invention.

DETAILED DESCRIPTION OF INVENTION

[0040] **FIGS. 1 through 14**, discussed below, and the various embodiments used to describe the principles of the present invention in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the invention. Those skilled in the art will understand that the principles of the present invention may be implemented in any suitably arranged data network.

[0041] **FIG. 1** is a block diagram of automated video distribution system **100** according to one embodiment of the present invention. Automated video distribution system **100** comprises a group of "M" subscriber sites (typically homes), including exemplary subscriber sites **110**, **120**, and **130**, and a group of "N" video point-of-presence (VPOP) networks, including exemplary VPOP network **150**, VPOP network **160**, and VPOP network **170**. Automated video distribution system **100** also comprises video Internet service provider (VISP) network **180**. The subscriber sites, VPOP networks, and VISP network **180** communicate over common communication network **140**, which is an Internet protocol (IP) based network, such as the Internet or one or more privately owned IP-based intranets.

[0042] Exemplary subscriber site **110** comprises television set **111** and exemplary network video player (NVP) **112** according to the principles of the present invention. Similarly, exemplary subscriber site **120** comprises television set **121** and exemplary network video player (NVP) **122** and exemplary subscriber site **130** comprises television set **131** and exemplary network video player (NVP) **132**. As will be described below in greater detail, subscribers use NVP **112**, NVP **122** and NVP **132** to access VISP network **180** in order to rent or purchase videos that are stored on one or more of VPOP network **150**, VPOP network **160** and VPOP network **170**. One or more of NVP **112**, NVP **122** and NVP **132** may be implemented as a stand-alone device, such as a set top box or a personal computer, attached to a corresponding one of television sets **111**, **121** and **131**. Alternatively, one or more of NVP **112**, NVP **122** and NVP **132** may be integrated into a corresponding one of television sets **111**, **121** and **131**.

[0043] Exemplary VPOP network **150** may comprise one or more workstations, collectively represented by workstation **151**, and one or more video access servers, collectively represented by VPOP server **152**. Similarly, exemplary VPOP network **160** may comprise one or more workstations, collectively represented by workstation **161**, and one or more video access servers, collectively represented by video access server **162**. Finally, exemplary VPOP network **170** may comprise one or more workstations, collectively represented by workstation **171**, and one or more video access servers, collectively represented by video access server **172**. As will be explained below in greater detail, each of VPOP networks **150**, **160** and **170** allows subscribers previously authenticated and authorized by VISP network **180** to access and download video files.

[0044] Finally, VISP network **180** comprises one or more workstations, collectively represented by workstation **181**, one or more servers, collectively represented by VISP server **182**, and one or more database storage devices, collectively represented by VISP database **183**. Among other things, VISP server **182** acts as a broker between a subscriber that wishes to download a selected video and a VPOP that has the selected video file.

[0045] It should be understood that the above-described embodiments of subscriber sites **110**, **120**, and **130**, VPOP networks **150**, **160**, and **170**, and VISP network **180** are illustrative only and that other architectures may be employed that do not depart from the spirit and scope of the invention. For example, in some embodiments of the present invention, one or more of NVP **112**, NVP **122** and NVP **132**, and VPOP networks **150**, **160**, and **170** may comprise a single desktop personal computer (PC) coupled to the Internet that provides a single subscriber with access to VISP network **180**. In some embodiments of the present invention, one or more of NVP **112**, NVP **122** and NVP **132** may be a laptop computer that is capable of accessing the Internet (i.e., common communication network **140**) via a wireless modem. Similarly, one or more of VPOP networks **150**, **160**, and **170** may be connected wirelessly to communication network **140**, such as by a satellite link.

[0046] **FIG. 2** is a more detailed block diagram of selected portions of automated video distribution system **100** according to one embodiment of the present invention. In particular, **FIG. 2** illustrates selected portions of subscriber site **110**, VPOP network **150**, VISP network **180** and common communication network **140**. Network video player (NVP) **110** in subscriber site **110** comprises browser software application **210** (hereafter, simply "browser **210**"), NVP controller **212**, and NVP storage device **214** (typically a disk drive, which stores downloaded videos. VPOP network **150** comprises VPOP web site software application **230** (hereafter, simply "VPOP web site **230**"), VPOP video access controller **232**, VPOP accounting controller **234**, and VPOP database **236**. Finally, VISP network **180** comprises VISP web site software application **220** (hereafter, simply "VISP web site **220**"), video distribution controller **222**, VISP accounting controller **224**, and VISP database **183**.

[0047] The term "controller" as used with respect to the items in **FIG. 2** is broadly defined and may mean any device, system or part thereof that controls at least one operation. Such a device may be implemented in hardware or software, or a combination of hardware and software. Furthermore,

the functionality associated with any particular controller may be centralized or distributed, whether locally or remotely. A controller may comprise one or more data processors, and associated input/output devices and memory, that execute one or more application programs and/or an operating system program.

[0048] In particular, NVP controller **212** may comprise software applications executed by the central processing unit (CPU) in NVP **112**, which may also execute browser **210**. Likewise, VPOP video access controller **232** and VPOP accounting controller **234** may comprise software applications executed by the central processing unit (CPU) in VPOP server **152**. VPOP server **152** may also execute VPOP web site **230**. Finally, video distribution controller **222** VISP accounting controller **224** may comprise software applications executed by the central processing unit (CPU) in VISP server **182**. VISP server **182** may also execute VISP web site **220**.

[0049] When the subscriber of subscriber site **110** first rents or buys a video file via VISP network **180**, NVP controller **212**, which may work in cooperation with browser **210**, gathers initial setup data from the subscriber, such as a personal name, credit card number, address information, and the like, and transfer this information to VISP accounting controller **224**. If the subscriber at subscriber site **110** has previously used VISP network **180**, a user name and password prompt may be used to quickly identify the subscriber and retrieve previously stored information from VISP database **183**. Thus, NVP controller **212** and VISP accounting controller **224** may be used to gather details about particular subscribers that have previously used VISP network **180** and also may be used to gather information from new subscribers that are using VISP network **180** for the first time.

[0050] When a subscriber wishes to buy or rent a video, the subscriber browses VISP web site **220**, which is capable of accessing VPOP web site **230** and other VPOP web sites in order to retrieve video files and related identification information stored on VPOP database **236**. Video distribution controller **222** guides the subscriber through a sequence of web site menus from which the subscriber may select a video. Video distribution controller **222** transfers information related to the selected video to VPOP video access controller **232** that allows the subscriber to subsequently communicate with VPOP video access controller **232** in order to download the selected video via communication network **140**. After the subscriber has selected a video to download, NVP controller **212** communicates with VPOP video access controller **232** to actually download the selected video file. Payment for the rented or purchased video and related invoicing information is then transferred from VISP accounting controller **224** to VPOP accounting controller **234**.

[0051] **FIG. 3** depicts message flow diagram **300**, which illustrates an exemplary end-to-end video rental or sale transaction between NVP **112**, VISP network **180** and VPOP network **150** according to one embodiment of the present invention. Initially, a subscriber using NVP **112** changes to the video services channel on television **111**. The process of changing to the video services channel initiates an IP connection between NVP **112** and VISP network **180**. At this point, VISP web site **220** at VISP network **180** appears on the screen of television **111**. The subscriber uses the TV remote control, wireless keyboard or a pointing device, such as a mouse coupled to NVP **112**, to browse WISP web site **220** to select the video content that he or she prefers to buy, rent or otherwise acquire. A variety of selection criteria may be used to select the video content. VISP network **180** then displays a list of VPOPs, including VPOP network **150**, offering the video content selected by the subscriber. The subscriber then chooses a VPOP from which to buy or rent the video content. The VPOP selection criteria may be determined by geographical location (quicker downloads), cost of the video content, and any other differentiator, whether based on technological constraints, economic issue, or any other related resource allocation issues, that the VPOPs use to attract and retain customers. The subscriber also chooses whether the video content is to be rented or purchased, and if rented, the duration of the rental (process step **305**).

[0052] Once the video content and VPOP selection is made, VISP network **180** authenticates the subscriber (possibly using subscriber account number, password, and the like) and collects payment information (credit card, add to cable bill, and the like) (process step **310**). VISP network **180** then asks VPOP network **150** to reserve a copy of the video content (Lock Video Request) requested by the subscriber by sending VPOP network **150** the subscriber's unique NVP ID. The NVP ID is a code embedded in NVP **112**. VISP network **180** also informs VPOP network **150** whether the video content is to be rented or purchased by the subscriber, and if rented, the rental duration (process step **315**).

[0053] VPOP network **150** responds by reserving a copy of the video content rented or purchased by the subscriber and sends a positive acknowledgment (Lock Video Acknowledgment) to VISP network **180**. VISP network **180** creates a billing record with the subscriber's account information and NVP ID for the video content rented or purchased (process step **320**). VISP network **180** then sends a positive acknowledgment to NVP **112** to begin downloading the video content from VPOP network **150** (process step **330**).

[0054] Next, NVP **112** connects to VPOP network **150** and provides information (Video URL) identifying the movie to be purchased or rented as well as the unique NVP ID of NVP **112** (process step **335**). VPOP network **150** verifies that a record exists for the NVP ID and the video content requested by NVP **112**. VPOP network **150** then downloads a file containing the requested video content to NVP **112** (process steps **340**, **345** and **350**). After the download is complete, VPOP network **150** informs VISP network **180** that the download is complete, providing VISP network **180** with the subscriber's NVP ID as well as identifying the video content rented or purchased. VISP network **180** then completes and closes the billing record created for the subscriber using NVP **112** (process step **355**).

[0055] **FIG. 4** depicts message flow diagram **400**, which illustrates an exemplary process of viewing a video already rented by the subscriber according to one embodiment of the present invention. Initially, the subscriber, using the remote control of television **111** or a pointing device coupled to NVP **112**, selects and plays the rented video. NVP **112** connects to VPOP network **150** from which the video was rented and requests VPOP network **150** to verify that the

rental duration for the video is still current. NVP **112** provides VPOP network **150** the video URL as well as the unique NVP ID of NVP **112** (process step **405**). VPOP network **150** locates the rental record for the NVP ID and video URL sent by NVP **112**. VPOP network **150** compares the time-stamp on the rental record with the current time to see if the video is within the rental duration paid for by the subscriber. If the video is still within the rental duration paid for by the subscriber, VPOP network **150** sends an acknowledgment to NVP **112** that the video may be viewed by the subscriber (process step **410**). NVP **112** then plays the video on television **111**.

[0056] **FIG. 5** depicts message flow diagram **500**, which illustrates an exemplary process of extending the rental duration for a video already downloaded to NVP **112** according to one embodiment of the present invention. Initially, the subscriber, using the remote control of television **111** or a pointing device coupled to NVP **112**, selects and plays the rented video. NVP **112** connects to VPOP network **150** from which the video was rented and requests VPOP network **150** to verify that the rental duration for the video is still current. NVP **112** provides VPOP network **150** the video URL as well as the NVP ID of NVP **112** (process step **505**). VPOP network **150** locates the rental record for the NVP ID and video URL sent by NVP **112**. VPOP network **150** compares the time-stamp on the rental record with the current time to see if the video is within the rental duration paid for by the subscriber. VPOP network **150** determines that the rental period on the video requested by NVP **112** has expired and sends a negative acknowledgment back to NVP **112** (process step **510**).

[0057] Next, NVP **112** prompts the subscriber to extend the rental duration and the subscriber elects to extend the rental duration for the video to be viewed. NVP **112** connects to VISP network **180** and sends a rental request providing VISP network **180** with the unique NVP ID of NVP **112**, the video URL and VPOP network **150** information (process step **515**). VISP network **180** then authenticates the subscriber and collects payment information (process step **520**).

[0058] Once payment is collected, VISP network **180** requests VPOP network **150** to reserve a copy of the video content requested by the subscriber by sending VPOP network **150** the unique NVP ID of NVP **112**. VISP network **180** also informs VPOP network **150** of the rental duration (process step **525**). VPOP network **150** responds by reserving a copy of the video content rented by the subscriber and sends a positive acknowledgment to VISP network **180**. In response, VISP network **180** creates a billing record with the subscriber's account information and the NVP ID of NVP **112** for the video content rented (process step **530**).

[0059] VISP network **180** sends a positive acknowledgment to NVP **112** to begin downloading the video content from VPOP network **150** (process step **535**). NVP **112** connects to VPOP network **150** and requests that the rental duration for the video be extended, providing VPOP network **150** with the corresponding video URL and the NVP ID of NVP **112** (process step **540**). VPOP network **150** verifies that a record exists for the NVP ID of NVP **112** for the video content requested by NVP **112**. VPOP network **150** then downloads a new header to NVP **112** with the rental extension information (process step **545**). VPOP network **150** informs VISP network **180** that the download is complete, providing VISP network **180** with the NVP ID of NVP **112** as well as the video content rented. VISP network **180** then completes and closes the billing record for the subscriber (process step **550**).

[0060] To carry out the exemplary transactions described above, each of the network components implementing the video network may carry out various processes that are described below.

[0061] **FIG. 6** illustrates exemplary header **600**, which may be attached to video files downloaded to NVP **112** according to one embodiment of the present invention. Exemplary header **600** comprises seven data fields. Field **605** in header **600** contains the URL of the VPOP network (e.g., VPOP network **150**) that provides the downloaded video file. The VPOP URL in field **605** allows NVP **112** to determine the source of the downloaded video file. The VPOP URL may subsequently used to validate whether the video is still within the rented duration, as well as to extend the rental duration if requested by the subscriber.

[0062] Field **610** in header **600** contains the URL of the selected video. The VIDEO URL allows NVP **112** to uniquely identify the video to VPOP network **150** as well as VISP network **180** during the rental, purchase, viewing, and extension transactions. Field **615** in header **600** contains the Compression Type. The Compression Type data tells NVP **112** what algorithm was used to compress the video content. This information is used by NVP **112** to decompress the stored video for viewing.

[0063] Field **620** in header **600** contains a data value indicating whether the video was rented or purchased by the subscriber. The Owned/Rented data value is used by NVP **112** to determine if it is necessary to check the rental period validity before playing the video on television **111**. Field **625** in header **600** contains a time stamp of the last time the video was played. The Time Last Checked data value is used by NVP **112** to determine if it is necessary to check with VPOP network **150** for rental period validity before playing the video on television **111**.

[0064] Field **630** in header **600** contains a checksum value for all of the data in header **600**. The Header Checksum value is used by NVP **112** to determine whether the header downloaded from VPOP network **150** during video rental transactions was received without errors. Field **635** in header **600** contains a checksum value for all of the video file, excluding header **600**. The Video Checksum value is used by NVP **112** to determine whether the video file downloaded from VPOP network **150** was received without errors.

[0065] **FIG. 7** illustrates exemplary header **700**, which may be attached to video files stored on VPOP network **150** according to one embodiment of the present invention. Exemplary header **700** comprises five data fields. Field **705** in header **700** contains the compression type. The Compression Type data identifies the algorithm used to compress the video content. This information is used to decode the video for viewing on NVP **112**. Field **710** in header **700** contains the number of copies of the video owned by VPOP network **150**. The Number of Copies Owned value determines how many copies of the video may be rented or sold by VPOP network **150**.

[0066] Field **715** in header **700** contains the number of copies of the video currently rented from VPOP network

150. The Number of Copies Rented value keeps a real-time record of the number of each video file that have been rented to subscribers. Field 720 in header 700 contains a checksum of the actual video content. The Video Checksum value is used during the video download process to ensure that all of the video content is correctly downloaded from VPOP network 150 to NVP 112. Field 725 in header 700 contains a pointer to an array of records, one for each copy of the video rented from VPOP network 150. The records array keeps track of which NVP rented each video and when the video was rented.

[0067] FIG. 8 illustrates exemplary header 800, which may be attached to records in VPOP database 236 for each copy of a video rented according to one embodiment of the present invention. Field 805 in header 800 contains the NVP ID of NVP 112, which belongs to the subscriber that rented the video. Field 810 in header 800 contains the time at which the video was rented by NVP 112. Field 815 in header 800 contains a status value indicating whether or not the video has been downloaded by NVP 112 or if a download is still pending.

[0068] VPOP network 150 can receive inputs from NVP 112, VISP network 180 or database updates from the local system administrator. Database updates to VPOP network 150 happen when new videos are added to or deleted from VPOP network 150 or if additional copies of an existing video are purchased. The addition of new videos requires VPOP network 150 to send the database updates to VISP network 180 to ensure that VISP network 180 has current information on all VPOPs carrying the newly added video. The database updates for adding more copies of an existing video are local changes and do not have to be sent to VISP network 180.

[0069] When VPOP network 150 receives a lock video request from VISP network 180, it checks the Number of Copies Rented field in the video's header. If the Number of Copies Rented is equal to the Number of Copies Owned field, then VPOP network 150 sends a Lock Video Request deny message back to VISP network 180. Otherwise, VPOP network 150 checks whether the Lock Video Request is a rental or purchase transaction. If it is a purchase transaction, VPOP network 150 decrements the Number of Copies Owned field, sets the Download Status field in that copy's header to "Purchase Download Pending" and sends a Lock Video Acknowledge message to VISP network 180. If the Lock Video Request from VISP network 180 is a rental transaction, VPOP network 150 increments the Number of Copies Rented field in the video's header, sets the Download Status field in that copy's header to "Rental Download Pending" and sends a Lock Acknowledge message to VISP network 180. In both rental and purchase transactions, VPOP network 150 updates the NVP ID field in that video copy's header with the NVP ID of NVP 112 requesting the transaction.

[0070] When VPOP network 150 receives a download or extension request from NVP 112, VPOP network 150 looks through the array of headers for the video requested to see if the NVP ID exists. If the NVP ID does not exist, VPOP network 150 sends an error message back to NVP 112. If the NVP ID exists and it is an extension request, VPOP network 150 sends a Download Complete message to VISP network 180 (along with NVP ID and VIDEO URL information) and sends a duration extended message to NVP 112. If the NVP ID exists and it is a download request, VPOP network 150 creates a new header for the video to be downloaded to NVP 112. VPOP network 150 fills in the VPOP URL, the VIDEO URL, the Compression Type value, the Owned/Rented value (based on whether the Download Status indicates purchase or rental pending), the Header Checksum value, and the Video Checksum value. The header is downloaded to NVP 112 first, followed by the actual video file.

[0071] If the download is successful, VPOP network 150 sends a Download Complete message to VISP network 180, providing the NVP ID, the VPOP URL, and the VIDEO URL. If the download is unsuccessful, VPOP network 150 checks the Download Status field in that video copy's header to see if the video was a rental or a purchase. If the video was a rental, VPOP network 150 decrements the Number of Copies Rented field in the video header. If it was a purchase transaction, VPOP network 150 increments the Number of Copies Owned field in the video header (the above two steps restore the original number of copies owned or rented and cancel out the pending transaction). VPOP network 150 also clears the NVP ID and Download Status fields from that video copy's header. Finally, VPOP network 150 sends a Download Failed message to VISP network 180 and provides the NVP ID and the VIDEO URL.

[0072] As introduced herein above, those skilled in the art will readily see that the video or other data content may suitably be downloaded in a variety of ways. According to one advantageous embodiment, for the purposes of downloading, the video file may be divided into a plurality of associated data segments. Each data segment is self contained and may be downloaded independently of the others and then used to reconstruct the video content at subscriber site 110. Advantageously, the data segments are sequenced numerically using file name extensions. Segmenting or otherwise breaking up the video files allows NVP 112 to start playing the movie after the first segment is downloaded. The other data segments continue to download while the first segment (and subsequent segments thereafter) continue to play. According to a related advantageous embodiment, individual segment size may be determined based on the slowest download speed to ensure that the next segment will be downloaded before the previous segment finishes playing on NVP 112.

[0073] According to yet another related embodiment, the download process may be interrupted because of a failure of VPOP network 150, thereby enabling NVP 112 to choose to continue downloading the segment content from another VPOP network 150 starting from the segment that was interrupted rather than starting the entire download process over again. This enables the subscriber to recover from errors without incurring the prolonged delay that would occur if the video file download were restarted from the beginning.

[0074] Besides browsing VISP network 180 web site and requesting video content to be rented or purchased, the subscriber can also select and view videos already downloaded to NVP 112. To select a locally stored video, the subscriber chooses the select option on the remote control or wireless keyboard. At this point, a list of all locally stored videos is displayed on the subscriber's television screen. The subscriber navigates through the list of videos and chooses

a video to be viewed. Once a video is selected, the subscriber can apply typical VCR commands like play, fast forward, rewind, pause and stop. The rewind, fast forward, pause and stop commands are completely local (do not require any transactions with VPOP network **150** or VISP network **180**). When one of these commands is chosen, NVP **112** performs the appropriate action on the locally stored video.

[**0075**] When the subscriber elects to play locally stored video that the subscriber has selected, NVP **112** checks the Owned/Rented field in the video's header to determine if the video is owned by the subscriber or rented. If the video is owned, then it is played on the subscriber's TV screen. If the video is rented, NVP **112** checks the Time Last Checked value in the video's header to determine the last time the video was played. If the Time Last Checked is within two hours of the current NVP time, then the video is immediately played on the subscriber's TV screen. If the time elapsed since the Time Last Checked value is greater than two hours, then NVP **112** uses the VPOP URL value in the video header to connect to VPOP network **150** from which the video is rented. NVP **112** also provides VPOP network **150** with the NVP ID of NVP **112**, as well as the VIDEO URL value stored in the video's header.

[**0076**] NVP **112** waits for VPOP network **150** to determine whether the video is within the video rental duration. If the video is still within the rented duration, NVP **112** updates the Time Last Checked value to the current time and plays the video on the subscriber's TV screen. If the video's rental duration has expired, NVP **112** prompts the subscriber to extend the video's rental duration. If the subscriber does not elect to extend the rental duration, NVP **112** deletes the video from local storage. If the subscriber elects to extend the rental duration, NVP **112** connects to VISP network **180** and provides it with the VPOP URL for VPOP network **150**, the VIDEO URL, and the NVP ID information. VISP network **180** then displays the user authentication screen on the subscriber's TV screen. The subscriber follows the authentication and payment processes described previously. When authentication is done, NVP **112** connects to VPOP network **150** and provides it with the VIDEO URL and NVP ID and requests to extend the video rental. After extension confirmation is received from VPOP network **150**, NVP **112** updates the Time Last Checked value to the current time and plays the video on television **111**.

[**0077**] **FIG. 9** illustrates exemplary web page **900** from which a subscriber using NVP **112** may select a video to rent or to purchase, according to one embodiment of the present invention. Web page **900** contains listings for three videos, "Rocky,""First Blood," and "Titanic," which the subscriber may rent using NVP **112**. Four selectable icons are associated with the "Rocky" video, including review icon **901**, download icon **902**, trailer icon **903**, and video cover icon **904**. Similarly, four selectable icons are associated with the "First Blood" video, including review icon **911**, download icon **912**, trailer icon **913**, and video cover icon **914**. Finally, four selectable icons are associated with the "Titanic" video, including review icon **921**, download icon **922**, trailer icon **923**, and video cover icon **924**. Selecting any one of the review icons transfers the subscriber to web page **1000**, explained below in **FIG. 10**, from which the subscriber may read a review of the corresponding movie. By selecting any one of the download icons, the subscriber may begin the process of downloading the selected video to NVP **112**. By selecting any one of the trailer icons, the subscriber may view a brief video clip from the corresponding video file. Selecting any one of the video cover icons transfers the subscriber to web page **1000**. In an advantageous embodiment of the present invention, video cover icons **904**, **914**, and **924** are smaller sized graphic images (typically in JPEG or GIF format) of the box cover of the corresponding video.

[**0078**] **FIG. 10** illustrates exemplary web page **1000** from which a subscriber using NVP **112** may learn additional details concerning a selected video, according to one embodiment of the present invention. The subscriber using NVP **112** enters web page **1000** by selecting, for example, one of video cover buttons **904**, **914**, or **924** in web page **900**. Web page **1000** comprises video cover icon **1001**, movie review text **1002**, selectable rent/buy icon **1003**, and selectable trailer icon **1004**.

[**0079**] Movie review text **1002** comprises a scrollable window containing text reviews and/or a synopsis of the corresponding video. Selecting trailer icon **1004** allows a subscriber to view a brief video clip from the corresponding video file. Selecting rent/buy icon **1003** leads to subsequent web pages that begin the process of downloading the selected video to NVP **112**. In an advantageous embodiment of the present invention, video cover icon **1001** is a larger sized graphic image (typically in JPEG or GIF format) of the box cover of the corresponding video.

[**0080**] **FIG. 11** is a more detailed block diagram of selected portions of exemplary network video player **112** according to one embodiment of the present invention. Network video player (NVP) **112** comprises IR sensor **1105**, NVP controller **212**, browser **210**, NVP storage device **214**, MPEG2 decoder/NTSC encoder **1110**, and video processor **1120**. In the embodiment shown, NVP **112** is implemented as a set-top box that receives television signals from a cable service provider for display of television set **111**. However, unlike a conventional cable box, NVP **112** is also capable of browsing the Internet and downloading and renting a video file or other data file. Advantageously, NVP **112** may access the Internet via the cable connection, such as by using a high-speed cable modem service. Alternatively, NVP **112** may use a separate connection, such as a digital subscriber line (DSL), to access the Internet. In other embodiments of the present invention, NVP **112** may receive external television signals from an antenna, rather than from a cable service provider.

[**0081**] **FIG. 12** depicts flow chart **1200**, which illustrates the operation of the exemplary network video player **112** according to one embodiment of the present invention. NVP controller **212** directs the overall operation of network video player **112**, including View mode, Play mode and Browse mode. In View mode, NVP controller **212** causes the incoming television signal from the cable service provider to be demodulated and processed by video processor **1120** and transmitted to television set **111**, without storing or retrieving from NVP storage device **214** (process step **1205**). Video processor **1120**, which may be, for example, a TriMedia (TM) **1100** media processor, contains radio frequency (RF) front-end circuitry for receiving incoming television signals from the cable service provider, tuning to a user-selected channel, and converting the selected RF signal to a baseband television signal (e.g., super video signal) suitable for display on television set **111**. Video processor **1120** also is

capable of receiving a conventional NTSC signal from MPEG2 decoder/NTSC encoder **1110** during Play mode and transmitting baseband television signal (e.g., super video signal) to television set **111**.

[0082] In Browse mode, NVP controller **212** launches browser **210** and directs video processor **1120** to receive its input video signal from browser **210**. Once launched, browser **210** receives user commands from, for example, a remote control or an infrared-capable wireless keyboard or mouse. Browser **210** accesses web pages from VISP network **180** and VPOP networks **150**, **160**, and **170**, as explained above, and causes video processor **1120** to display the web pages on television set **111**. Video previews, such as MPEG2 video files, received by browser **210** may be transferred to MPEG2 decoder/NTSC encoder **1110** for display in a window on television set **111**. Eventually, the user may rent and download a video or other data file. The downloaded video file is stored in NVP storage device **214** for subsequent playback on television set **111** (process step **1210**). In Play mode, NVP controller **212** directs NVP storage device **214** to stream a downloaded, rented video file to MPEG2 decoder/NTSC encoder **1110**, which converts the MPEG2 data from NVP storage device **214** to, for example, a super video (S-Video) signal that video processor **1120** transmits to television set **111** (process step **1215**).

[0083] The MPEG2 standard was chosen for MPEG2 encoder **220** and MPEG2 decoder/NTSC encoder **1110** only for the purposes of explaining the invention. In alternate embodiments of the present invention, the MPEG encoder and decoder may comply with the MPEG-1, MPEG-2, MPEG-4 or MPEG-7 standards.

[0084] For the purposes of this application and the claims that follow, NVP storage device **214** is defined to include any mass storage device that is both readable and writable, including conventional magnetic disk drives, magnetic tapes for a video cassette recorder (VCR) or video tape recorder (VTR), and optical disk drives for read/write digital versatile disks (DVD-RW), rewritable CD-ROMs, and the like. In fact, NVP storage device **214** need not be "fixed" in the conventional sense that it is permanently embedded in network video player **112**. Rather, NVP storage device **214** includes any mass storage device that is dedicated to network video player **112** for the purpose of storing recorded video programs. Thus, NVP storage device **214** may include an attached peripheral drive or removable disk drives (whether embedded or attached), such as a juke box device that holds read/write DVDs or re-writable CD-ROMs. Furthermore, in an advantageous embodiment of the present invention, NVP storage device **214** may include external mass storage devices that network video player **112** may access and control via a network connection (e.g., Internet protocol (IP) connection), including, for example, a disk drive in the user's home personal computer (PC) or a disk drive on a server at the user's Internet service provider (ISP).

[0085] **FIG. 13** illustrates in greater detail selected portions of VPOP network **150** and NVP **112** that download video, audio and other digital data files in block bursts according to one embodiment of the present invention. VPOP network **150** comprises VPOP database **236**, segmentation controller **1330**, encryption controller **1340**, and transmission controller **1350**. VPOP database **236** stores exemplary video files **1301-1303**, exemplary audio files **1311** and **1312**, and decryption keys **1320**. In the illustrated embodiment, video files **1301-1303** are arbitrarily labeled VIDEO 1, VIDEO 2, and VIDEO 3, respectively, and audio files **1311** and **1312** are arbitrarily labeled AUDIO 1 and AUDIO 2, respectively.

[0086] NVP **112** comprises NVP storage device **214**, decryption controller **1355**, and video-audio processor **1360**. NVP storage device **214** stores segments **1315-1317**, which are arbitrarily labeled SEGMENT 1, SEGMENT 2, and SEGMENT 3, respectively. Video-audio processor **1360** is coupled to television set **111**. If NVP **112** is downloading video files from VPOP network **150**, video-audio processor **1360** plays the video track on the screen of television set **111** and plays the accompanying audio track on the speakers of television set 111. If NVP **112** is downloading audio files from VPOP network **150**, video-audio processor **1360** may play the audio file on the speakers of television set **111**. In alternate embodiments, video-audio processor **1360** may play an audio file directly on stand-alone speakers not connected to a television or other device.

[0087] VPOP network **150** may receive a request from NVP **112** for a specific digital data file. In this illustration, VPOP network **150** receives a request from NVP **112** for a specific file, video file **1301**. Video file **1301** is a complete video movie and is digitized at VPOP network **150** using standard commercially available digitizing schemes. Prior to transmitting video file **1301** to NVP **112**, VPOP segmentation controller **1330** divides digitized video file **1301** into segments prior to downloading. Each of the segments represents a viewing interval (e.g., each file comprises a predetermined portion of the video) and all of the files together are a complete video.

[0088] The length of the viewing interval depends on the size of a segment. The viewing interval can be adjusted to the network (here, the Internet) over which segments **1315-1317** are intended to be distributed. Adjusting the length of the viewing interval comprises adjusting the size of the segments into which video file **1301** is divided. The average available bandwidth on network **140** determines the size of the segments (i.e., more average available bandwidth allows smaller segments).

[0089] The size of each of segments **1315-1317** can be adjusted by segmentation controller **1330** to provide longer or shorter viewing intervals. A longer viewing interval compensates for network problems by providing a longer time window within which a subsequent segment may be downloaded before the viewer finishes viewing the current segment. At the same time, if the first segment downloaded to NVP **112** is relatively large, the viewer must wait a longer period before viewing the first video segment than with for a relatively small segment.

[0090] After video file **1301** is divided into segments by segmentation controller **1330**, each segment is then individually compressed by segmentation controller **1330** using standard video and audio compression codecs or other data reduction techniques for non-video or audio data. After the compression process is complete, each compressed video segment is passed to encryption controller **1340** and individually encrypted using a different encryption and decryption key pair for each segment. The use of separate encryption and decryption key pairs for each video file provides much greater protection of the distributed content. If one

encryption and decryption key pair is compromised or if someone is able to break the encryption of one video segment, then only one segment is compromised.

[0091] Segments **1315-1317** are transmitted to NVP **112** and stored in NVP storage device **214**. If NVP has been verified as authorized to receive and play video file **1301**, decryption keys are sent to NVP **112** and are used by decryption controller **1355** to decrypt segments **1315-1317**. As segments **1315-1317** are being loaded into memory, the first segment (i.e., segment **1315**) is retrieved by video-audio controller **1360** from NVP storage device **214**. After verification of NVP **112**, the first decryption key (not shown) is used to decrypt segment **1315** and decrypted segment **1315** is played by video-audio controller on television set **111**. Succeeding segments **1316-1317** are played on TV **111** after decryption controller **1355** applies a decryption key corresponding to each segment, respectively. Video file **1301** is viewed by a subscriber on TV **111** as NVP **112** plays each segment, in order, and stores segments **1315-1317** in memory for later replay. Further, during the rental period, segments **1315-1317** that are stored in NVP storage device **214** are a complete video and may be viewed as any other video during the rental period.

[0092] **FIGS. 14A and 14B** are a flow chart depicting method **1400** for securely distributing digital data files over a network, according to one embodiment of the present invention. The rental process for renting digital data files in the form of video files, audio files and other data files has been described earlier in **FIG. 3**. The method for distributing a digital data file over a network, in this illustration a video file, begins with a selection of a video file stored in VPOP database **236** on VPOP network **150**. After a video file is selected by a subscriber, VISP network **180** checks the status of the subscriber and collects payment information (process step **1405**). VISP network **180** then prompts VPOP network **150** to begin the download process of the selected video. Segmentation controller **232** divides the entire video into individual video segments **1315-1317** whose size depends on the determination by transmission controller **1350** of the available bandwidth of the network (process step **1410**). Each video segment is then compressed (process step **1415**) and each video segment is encrypted using encryption and decryption key pairs. The decryption keys for each video segment are stored in VPOP database **236** on VPOP network **150** (process step **1420**). VPOP transmission controller **232** then begins to download the video segments to the requesting subscriber device (process step **1425**).

[0093] After the first video segment is received by the requesting subscriber device (NVP **112**), the subscriber is prompted by NVP **112** on TV **111** display screen with a statement such as, "The video is ready for viewing. Do you want to play it?", or the like (decision step **1430**). If the subscriber declines to play the video, the process returns to decision step **1430** and repeats the statement until the subscriber answers "yes" (process step **1440**).

[0094] Referring now to **FIG. 14B**, after receiving a positive response, NVP **112** then makes a secure connection to VPOP network **150** and sends a request to VPOP network **150** to verify that the video segments that are being received into local storage at NVP **112** have been legitimately rented by NVP **112** and that the rental period has not expired (decision step **1445**). The subscriber may view a previously downloaded video file that is stored in its entirety in NVP storage device **214** if the rental period has not yet expired or will not expire during the requested rental period. If the rental period has expired or will expire during the new viewing period, depending on VISP network **180** operator and the agreement with VPOP network **150**, VISP network **180** prompts the subscriber to approve charges to the subscriber's account or credit card, or cancels the procedure (process step **1455**).

[0095] VPOP network **150** then determines whether the rental period has been verified (decision step **1460**). If the rental period has expired, the subscriber is prompted to rent another video (process step **1465**). If a successful verification is signaled (rental period has not expired), VPOP network **150** sends the appropriate decryption keys to NVP **112** for all the video segments of the video file that was rented (process step **1470**). NVP **112** then uses the first decryption key for the first video segment and begins to play the video by beginning playback of the first video segment. The remaining decryption keys are applied to each respective video file just prior to playback (process step **1475**).

[0096] During the initial download of video file **1301**, as the first video file and successive files are being played, the remaining video files are being downloaded in the background. As long as the download of each subsequent video file is faster than the viewing time of an immediately prior video, the user does not perceive any video degradation. The transmission controller determines the average bandwidth of the communications network and transfers the segments at least as fast as the available bandwidth allows. Since the length of each video file can be optimized for the current conditions of the communication network, a subsequent video segment should arrive prior to the completion of the currently playing segment. Only an average bandwidth requirement is placed on the network and not a constant bandwidth requirement as that required in the data streaming mode. Downstream bandwidth may vary (be faster or slower) at any instant in time as long as the variance falls within each video segment viewing period (which could be several minutes). Therefore, an average bandwidth, slightly larger than that at which the video segment is encoded, is achieved.

[0097] Once all video segments of the video file are downloaded, the video file is fully available from NVP storage device **214**. All video control functions including rewind, forward, pause, stop, etc. can then be performed locally on the video file. Every time the Play button is pressed NVP **112** determines the last time that NVP **112** checked with VPOP network **150** for verification. If that period is greater than a predetermined time (i.e., two hours) NVP **112** re-checks with VPOP network **150** for rental period verification to make sure that the video can be played by NVP **112**.

[0098] The decryption keys are not stored in local storage of NVP **112**. Whenever a stored video is to be played NVP **112** validates the rental period of the video with VPOP network **150** and then obtains a copy of the decryption keys from VPOP database for the digital content (video segments) from VPOP network **150**. VPOP network **150** maintains full control of the video file, through the decryption keys, even though the video may be distributed to many client devices (NVPs) and stored in the local storage of these devices. The

fact that the video does not have to be downloaded on every rewind operation saves shared network bandwidth for use by other devices on the network providing a much more scalable solution. Only the decryption keys are downloaded each time the video is played (and only if it is a new play operation as opposed to a rewind and replay). For rewind and then play the VPOP network **150** is not checked unless the last time NVP **112** checked with VPOP network **150** exceeds a certain, predetermined period of time.

[**0099**] Although the present invention has been described in detail, those skilled in the art should understand that they can make various changes, substitutions and alterations herein without departing from the spirit and scope of the invention in its broadest form.

What is claimed is:

1. A digital content server capable of transmitting a selected digital data file comprising at least one of a video file and an audio file to a subscriber device via a communication network, said digital content server comprising:

a memory for storing said selected digital data file and a plurality of encryption keys and a plurality of corresponding decryption keys;

a segmentation controller capable of dividing said selected digital data file into a plurality of segments;

an encryption controller capable of encrypting each of said plurality of segments with a selected one of said plurality of encryption keys; and

a transmission controller capable of determining an average bandwidth of said communication network over an N second period and transmitting said plurality of encrypted segments to said subscriber device in an N second period at an average data rate at least equal to said average bandwidth of said communication network and wherein said transmission controller is capable of transmitting said decryption keys to said subscriber device.

2. The digital content server as set forth in claim 1 wherein said transmission controller is capable of transmitting said stored decryption keys to said subscriber device upon receipt of a verification signal.

3. The digital content server as set forth in claim 2 wherein said transmission controller receives verification from said subscriber device.

4. The digital content server as set forth in claim 1 wherein said segmentation controller is capable of adjusting the size of each one of said plurality of segments.

5. The digital content server as set forth in claim 4 wherein said segmentation controller is capable of adjusting the size of each one of said plurality of segments according to parameters set by said transmission controller.

6. The digital content server as set forth in claim 5 wherein the parameters set by said transmission controller are one of equal to the average bandwidth and exceed the average bandwidth of said communications network.

7. The digital content server as set forth in claim 1, wherein said decryption keys are sent to the subscriber device each time the selected file is played and said decryption keys are required only when a predetermined time period elapses between verification checks by said subscriber device.

8. The digital content server as set forth in claim 1 wherein said encryption controller is capable of compressing each segment prior to encryption.

9. A communication network comprising:

a plurality of subscriber video players capable of receiving digital content files; and

a digital content server capable of transmitting a selected digital data file comprising at least one of a video file and an audio file to a subscriber device via a communication network, said digital content server comprising:

a memory for storing said selected digital data file and a plurality of encryption keys and a plurality of corresponding decryption keys;

a segmentation controller capable of dividing said selected digital data file into a plurality of segments;

an encryption controller capable of encrypting each of said plurality of segments with a selected one of said plurality of encryption keys; and

a transmission controller capable of determining an average bandwidth of said communication network over an N second period and transmitting said plurality of encrypted segments to said subscriber device in an N second period at an average data rate at least equal to said average bandwidth of said communication network and wherein said transmission controller is capable of transmitting said decryption keys to said subscriber device.

10. The communication network as set forth in claim 9 wherein said transmission controller is capable of transmitting said stored decryption keys to said subscriber device upon receipt of a verification signal.

11. The communication network as set forth in claim 9 wherein said transmission controller receives verification from said subscriber device.

12. The communication network as set forth in claim 9 wherein said segmentation controller is capable of adjusting the size of each one of said plurality of segments.

13. The communication network as set forth in claim 12 wherein said segmentation controller is capable of adjusting the size of each one of said plurality of segments according to parameters set by said transmission controller.

14. The communication network as set forth in claim 13 wherein the parameters set by said transmission controller are one of equal to the average bandwidth and exceed the average bandwidth of said communications network.

15. The communication network as set forth in claim 14 wherein said decryption keys are sent to the subscriber device each time the selected file is played and said decryption keys are required only when a predetermined time period elapses between verification checks by said subscriber device.

16. The communication network as set forth in claim 15 wherein said encryption controller is capable of compressing each segment prior to encryption.

17. A method for transmitting a selected digital data file comprising at least one of a video file and an audio file to a subscriber device via a communications network, comprising the steps of:

dividing said digital data file into a plurality of segments, wherein said segments are adjustable in size;

encrypting each of said plurality of segments with a selected one of a plurality of encryption keys;

storing a plurality of decryption keys corresponding to said plurality of encryption keys; and

transmitting each said encrypted segment via said communications network to said subscriber device at an average data rate at least equal to an average bandwidth of said communications network.

18. The method as set forth in claim 17 further comprising the step of transmitting said decryption keys to said subscriber device upon receipt of a verification signal.

19. The method as set forth in claim 18 further comprising the step of adjusting the size of each one of said plurality of segments according to parameters set by said transmission controller wherein the parameters are one of, equal to the average bandwidth and exceed the average bandwidth of said communications network.

20. The method as set forth in claim 19 further comprising the step of, responsive to a verification signal, transmitting a copy of said stored decryption keys to said subscriber device for decrypting each said encrypted segment.

21. The method as set forth in claim 20 the steps of:

said subscriber device verifying a predetermined time period of use of said selected digital data file; and

transmitting said decryption keys to said subscriber device only if said time period is exceeded.

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